Memoirs of Museum Victoria 58(2): 347–364 (2001)

THREE NEW SPECIES OF *CIROLANA* LEACH, 1818 (CRUSTACEA: ISOPODA: CIROLANIDAE) FROM AUSTRALIA

STEPHEN J. KEABLE

Crustacea Section, Australian Museum, 6 College Street, Sydney, NSW 2010, Australia

Abstract

Keable, S.J., 2001. Three new species of *Cirolana* Leach, 1818 (Crustacea: Isopoda: Cirolanidae) from Australia. *Memoirs of Museum Victoria* 58 (2): 347–364.

Three new species are described from Australia. *Cirolana australis* sp. nov. off eastern and southern coasts of Tasmania, *C. comata* sp. nov. off north-eastern Queensland, and *C. dissimilis* sp. nov. off northern Western Australia, Northern Territory and northern Queensland. All appear to be associated primarily with coral or rocky reef habitat. *Cirolana comata* and *C. dissimilis* occur on the continental shelf, *C. australis* on the continental slope at depths exceeded by few other species of *Cirolana*. The species are abundant in collections made using baited traps, indicating that they are scavengers and potentially important pests of fisheries. They have nodular sculpting on the pereon, pleon and pleotelson but differ from other Australian species with similar ornamentation in having the setae on the lateral margin of the uropod endopod in a continuous row, not in discrete widely spaced groups. *Cirolana comata* and *C. dissimilis* are sexually dimorphic and have a highly sclerotized robust seta on the posterodistal angle of the basis of pereopods 4–5. These and other shared characters suggest that the two are related.

Introduction

Twenty-nine named and one unnamed species of *Cirolana* Leach, 1818 were included in the most recent key to the Australian fauna (Bruce, 1986). *Cirolana schioedtei* Miers, 1884 has subsequently been transferred to *Aatolana* Bruce, 1993 (Bruce, 1993). The juvenile specimens included in this key and discussed as *Cirolana* sp. apparently represent an undescribed species of *Plakolana* Bruce, 1993, and *C. binyana* Bruce, 1991 is also a species of *Plakolana* (Bruce, 1993). Brusca et al. (1995) listed 84 species of *Cirolana* worldwide. *Cirolana obtruncata* Richardson, 1901 was moved to *Neocirolana* Hale, 1925 by Javed and Yasmeen (1990), *C. fornicata* (Mezhov, 1981) is regarded as a species of *Metacirolana* Kussakin, 1979 (Bruce, 1996), and Keable (1999) transfered *C. porcellana* Barnard, 1936 and *C. albicauda* Nunomura, 1985 (not listed by Brusca et al., 1995) to *Dolicholana* Bruce, 1986 as suggested by Bruce (1986). These changes, and the species described by Kwon (1988), Weider and Feldmann (1992), Bruce (1995), Javed and Yasmeen (1995) and Botosaneanu and Iliffe (1997), brings the recognised species to 90 (including one species inquirenda, three incertae sedis and one fossil species). Botosaneanu and Iliffe (1997) discussed the similarities of *Anopsilana* Paulian and Delmare Deboutteville, 1956 and *Cirolana* and suggested that *Anopsilana* is a subgenus of *Cirolana*. They recognised that this is an artificial solution and it is not followed here.

Scavenging cirolanid isopods play an important role in marine foodwebs (Keable, 1995) and are significant pests of fisheries (Bird, 1981; Stephen and Brusca, 1985; Berrow, 1994; Mizzan, 1995). This study describes three new scavenging species of *Cirolana* from Australia collected with baited traps.

The terminology and procedures used follow Keable (1997). Abbreviations are: AM, Australian Museum, Sydney, Australia; BMNH, The Natural History Museum, London, United Kingdom; NMV, Museum Victoria, Melbourne, Australia; NTM, Northern Territory Museum of Arts and Sciences, Darwin, Australia; TM, Tasmanian Museum and Art Gallery, Hobart, Australia; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA; n, number of specimens; CE, cephalon; A1, antennule; A2, antenna; CL, clypeal region; FL, frontal lamina; MD, mandible; MP, maxilliped; MX1, maxillule; MX2, maxilla; PE, penes; PN, pleon; P1-7, pereopods 1–7; U, uropod; PL1-5, pleopods 1–5; PT, pleotelson.

Cirolana Leach, 1818

Remarks. For useful recent synonymies, diagnoses, descriptions and discussions see Bruce (1986: 139), Kensley and Schotte (1989: 132), Bruce (1993: 2), Bruce (1995: 376) and Brusca et

al. (1995: 17). Revisionary work has provided increasingly narrower and more practical morphological limits to *Cirolana* with the transfer of many species to other genera (e.g. Bruce, 1981a; 1993). Three informal subgroups of *Cirolana* have also been proposed by Bruce (1986, 1995): (1) the "*C. parva* group"; (2) the "*C.* southern group"; and (3) the "*C.* tuberculate group". The new species described here (and several others) cannot be unambiguously placed in any group: the rostrum does not meet the frontal lamina and there is some sculpting on the body segments of all three species eliminating them from the "*C. parva*" group; and they cannot be members of the "*C.* southern" or the "*C.* tuberculate" groups because they have continuous setae on the lateral margin of the uropod exopod. This, combined with the character conflict which exists between these informal groups, suggests that they may be based on plesiomorphic or homoplastic characters. A phylogenetic analysis to resolve this issue is needed.

All species of Australian *Cirolana* with nodular sculpting in the form of tubercles, and that are otherwise similar to the three new species, have the uropod exopod lateral margin with discontinuous plumose setae (i.e. occurring in widely spaced groups) and fewer robust setae, or the rostrum meeting the frontal lamina.

A close relationship between *Cirolana comata* sp. nov. and *C. dissimilis* sp. nov. is suggested by many similarities, in particular corresponding sexually dimorphic characters rare in species of *Cirolana* (Bruce, 1986: 140). Both have a highly sclerotized robust seta on the posterodistal angle of the basis of pereopods 4–5 (4–6 in *C. comata*). This character does not occur in *C. australis* sp. nov., nor in *C. australiense* Hale, 1925, *C. capricornica* Bruce, 1986 or *C. similis* Bruce, 1981b (specimens AM P47660, P47668, P47669 examined). Its distribution is otherwise undocumented. Additionally, an iridescent brush formed by the aesthetases of the antennule (Keable, 1998; Parker, in prep.) was found in both *C. comata* and *C. dissimilis* but not *C. australis*.

The three new species appear to be associated primarily with coral or rocky reefs. *Cirolana comata* and *C. dissimilis* occur on the continental shelf, *C. australis* on the continental slope. Of the species currently placed in *Cirolana* or incertae sedis, only *C. bisulcata* Hobbins and Jones, 1993, *C. bougaardti* Kensley, 1984, *C. meseda* Hobbins and Jones, 1993, *C. vanhoeffeni* Nierstrasz, 1931 and *C. stebbingi* Nierstrasz, 1931 are known from similar or greater depths than *C. australis*.

Cirolana australis sp. nov.

Figures 1–3

Cirolana new species.—Koslow and Gowlett-Holmes, 1998: 41.

Cirolana n.sp. 4.—Lowry, 1998: 63, 64.

Material examined. Holotype. Main Pedra Seamount, off southern Tasmania (44°15.6′S 147°7.8′E), baited trap, 1,312 m, 21–24 Jan 1997 (CSIRO Cruise SSO1/97, stn 8), AM P59351 (male, 23 mm).

Paratypes. All same data as holotype. AM P59352 (977 specimens); BMNH 2000.2408–2409 (male, female); NMV J47153 (male, female); TM G3588 (2 females); USNM 296460 (male, female).

Additional material. E of Forteseue Bay, Tasmania (43°08.96′S 145°15.36′E), baited trap, 5.1°C, 1000 m, J. Lowry and P. Freewater, 16–17 Apr 1993 (stn SEAS TAS-365), AM P59353 (2 females, 1 male, 6 mancas); stn SEAS TAS-367, AM P59354 (7 females, 1 male, 5 mancas).

Diagnosis. Cephalon: rostrum not extending to frontal lamina, not dividing antennules; anterior margin not overriding antennules. Eyes: well developed, round. Frontal lamina: anterior margin angled. Pereonites: 1–7 with 2 transverse carinae; 4–7 with tubercles. Pleonites: 3–5 with tubercles. Pleonite 4: ventral margin free of pleonite 3; posterodorsal margin apex broadly rounded dorsally but meeting convex ventral margin at a point. Pleotelson: dorsal surface with paired tubercles in rows, (3 in each row, forming an indistinct ridge parallel to each lateral margin), conspicuous fine setae absent; anterolateral margins convex; posterolateral margins concave; apex truncate; 2–6 (usually 2 or 4) robust setae across apex. Penes: present. Pereopod 1: propodus without plumose setae. Pereopods 4–6: basis posterodistal angle robust setae absent. Pleopod 2 appendix masculina: arising subbasally; extending beyond tip of endopod, 1.46 length of endopod from insertion point; margins sinuate, tapering along entire length; slender; apex not at angle to margins, bluntly rounded. Uropods: endopod not dimorphic; lateral margin straight for proximal two-thirds, convex at distal third; exopod not dimorphic; lateral margin straight, robust and plumose setae continuous along margin.

Additional descriptive characters based on holotype. Body: length approximately 2.6 greatest width; white in alcohol; chromatophores absent; cuticular surfaces scale-like.

Cephalon: tubercles absent. Eyes: visible in ventral view; black in alcohol; partially overlapped by pereonite 1; ommatidia in rows, 7 ommatidia in horizontal diameter, 7 ommatidia in vertical diameter. Interocular furrow: distinct, not extending across cephalon. Frontal lamina: length approximately 1.9 basal width; penta-

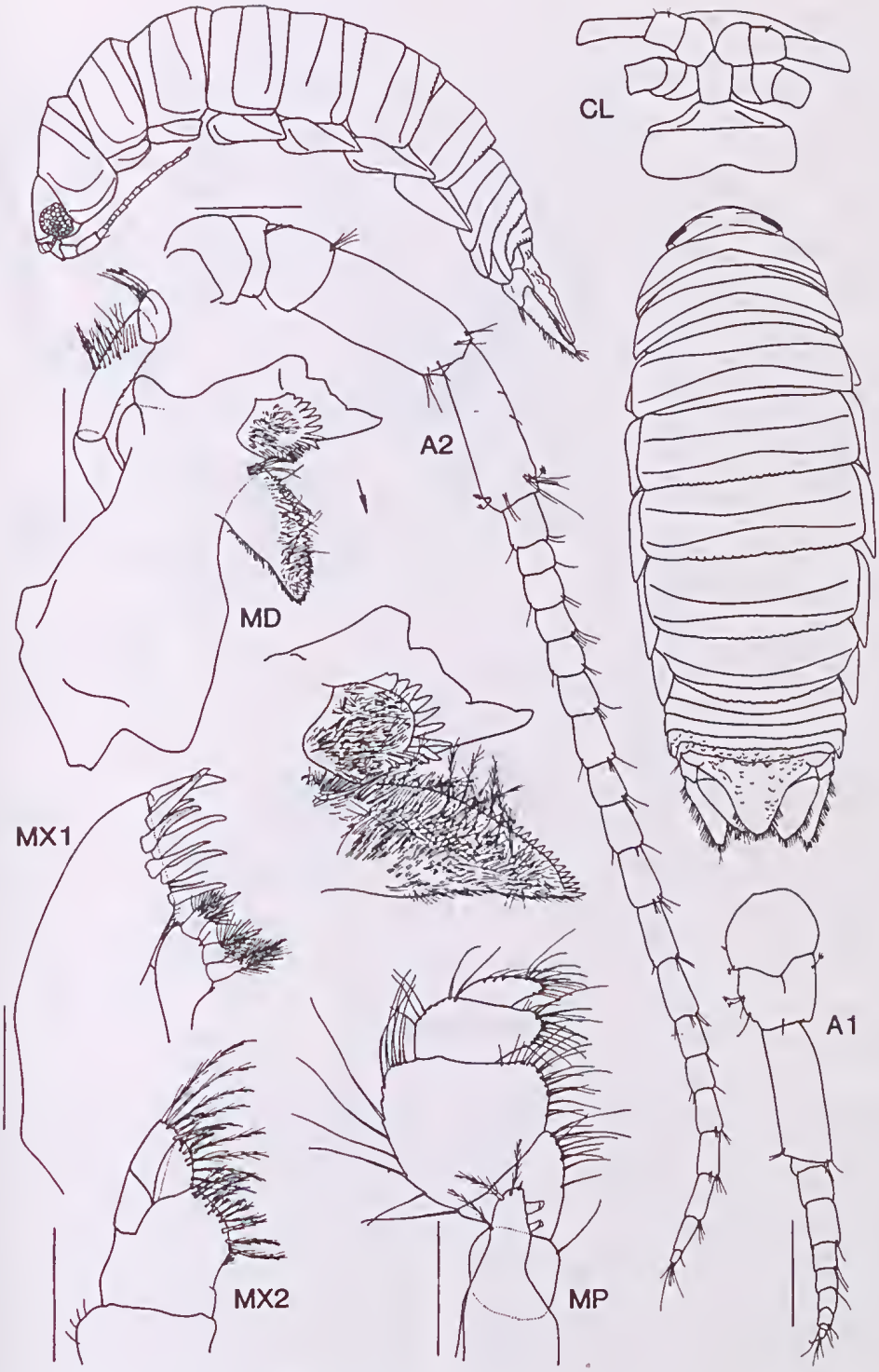

Figure 1. *Cirolana australis* sp. nov., holotype. Scales = 0.5 mm.

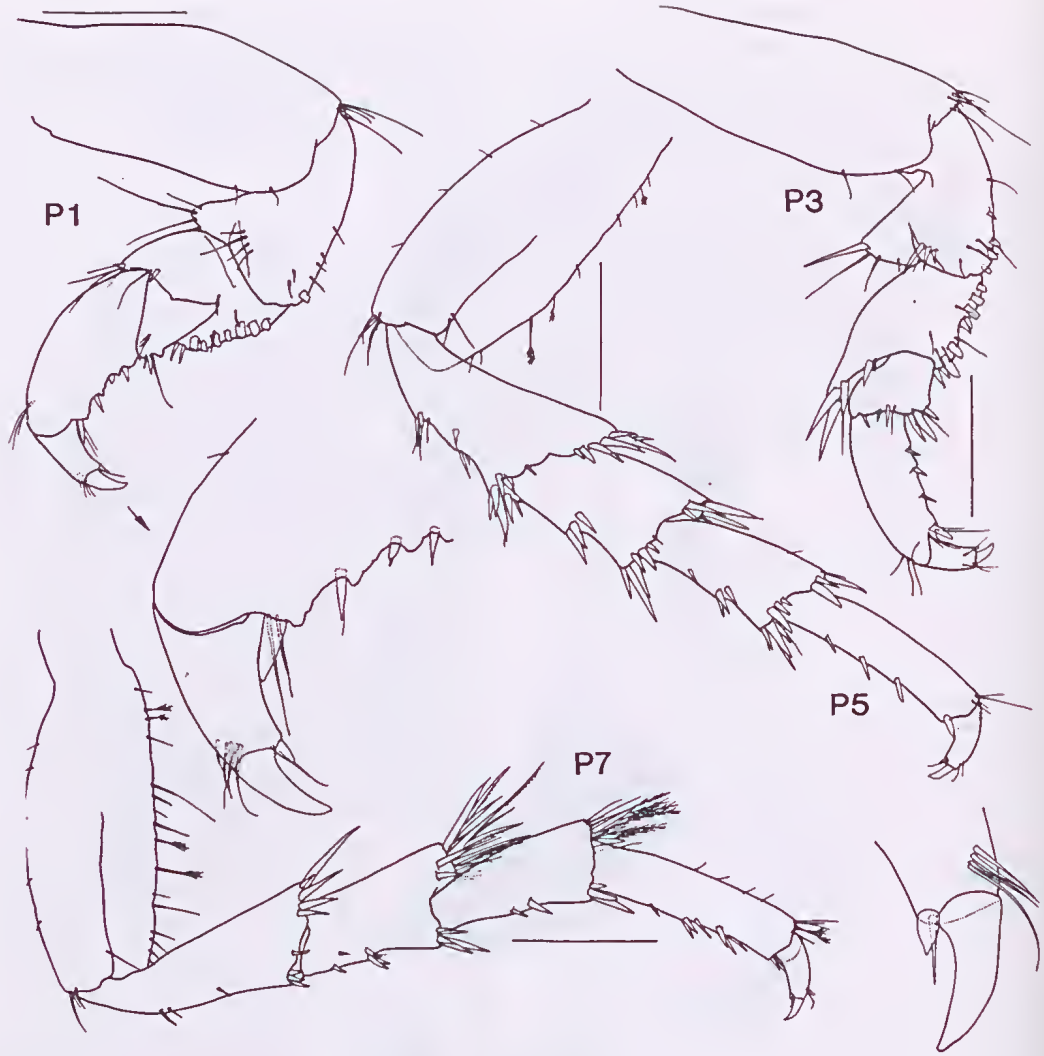

Figure 2. *Cirolana australis* sp. nov., holotype. Scales = 0.5 mm.

gonal; lateral margins divergent; apex not projecting, not visible in dorsal view, not expanded, in 1 plane (not stepped). Clypeus: triangular, not produced.

Pereonites: 4–7 length subequal and longest, 1–3 subequal; tubercles small, fine, subequal, continuous across entire posterior margin.

Pleonites: 1–5 equally visible along dorsal margin; tubercles small, subequal, continuous across entire posterior margin.

Pleotelson: length 0.85 basal width; anterodorsal uropodal sutures present; 4 robust setae across apex; plumose setae restricted to posterolateral margins, numerous proximal to robust setae.

Antennule: just reaching pereonite 1. Peduncular bases touching; articles 1–2 free; article 1 length less than width, subequal to article 2; article 2 longer than wide, with a few scattered slender and penicillate setae; article 3 longer than combined lengths of articles 1–2, length greater than width. Flagellum shorter than peduncle; articles not compressed (lengths of most greater than half width); 8-articulate; aesthetases not iridescent. Antenna: 0.3 length of body, when extended against body reaching to posterior of pereonite 3. Peduncular article 2 shorter than article 3; article 4 much longer than article 3, posterodistal angle with 4 slender setae, anterodistal angle with 5 slender setae; article 5 subequal in length to article 4, posterodistal angle with 2 penicillate and 2 slender setae, anterodistal

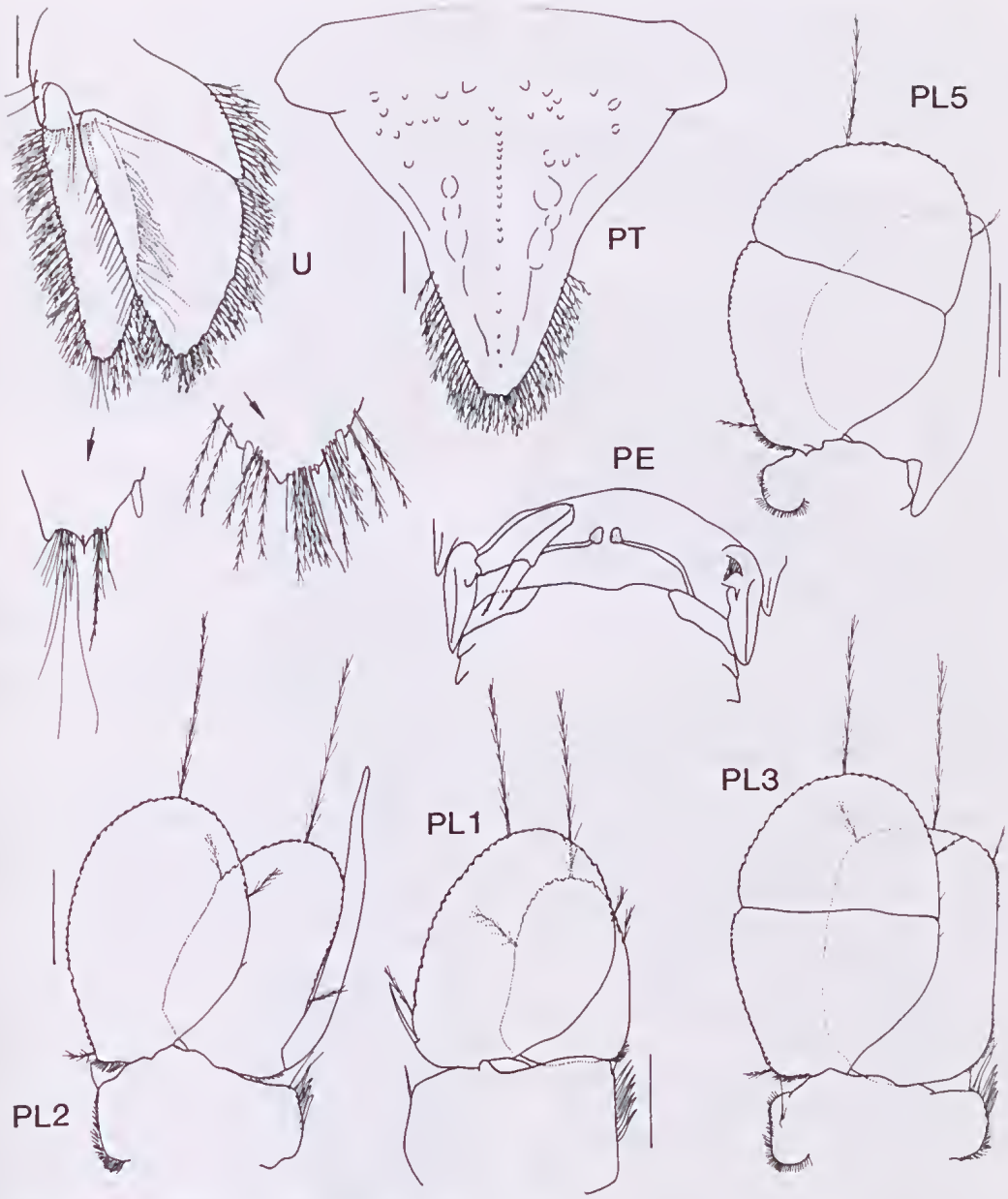

Figure 3. *Cirolana australis* sp. nov., holotype. Scales = 0.5 mm.

angle with 1 penicillate and 7 slender setae. Flagellum 19-articulate; setal brush absent.

Mandible: molar medial surface covered with short fine slender setae, cluster of long slender setae proximally present, long slender setae in submarginal row across 0.75 length of anterior margin; marginal robust setae close set. Setal row with 15 robust setae; medial surface covered in fine setae. Maxillule: medial lobe lateral margin protuberance absent; lateral lobe with 10 robust setae on distal surface and 2 slender setae. Maxilla: lateral lobe with 4 plumose and 1 slender setae; medial lobe with 14 plumose setae, medial plumose setae subequal to proximal setae; middle lobe with 4 plumose and 8 slender setae. Maxilliped: right endite with 1 coupling hook, left endite with 2 coupling hooks.

Pereopods: 1–3 merus posterior margin robust setae strongly molariform on 1 only; 2–7 coxal furrows complete. Pereopod 1: posterior margin setose fringe absent; propodus robust; daetylus shorter than 0.5 propodus length.

Penes: separated by more than width of both penes; forming flattened lobes; length approximately 1.5 basal width.

Pleopods: exopod suture complete on 3–5. Pleopod 1: exopod medial margin tapering evenly, proximolateral robust seta present; endopod shorter than exopod, lateral margin slightly coneave.

Uropods: extending beyond pleotelson. Peduncle ventrolateral angle without robust setae, with 13 plumose setae; lateral margin robust seta absent; distolateral angle rounded. Endopod medial margin convex, with 5 robust setae, plumose setae along entire length; apex subbifid with lateral spine largest, with 1 minute medial robust seta, setal eluster formed by plumose and slender setae; lateral margin with 4 robust setae, plumose setae along entire length. Exopod 0.94 length of endopod; medial margin convex, with 4 robust setae, plumose setae along entire length; apex subequally bifid, without robust setae, setal eluster formed by slender setae; lateral margin with 7 large robust setae, plumose setae along entire length.

Sexual dimorphism. Females differ from males only in the primary sexual characters.

Variation. Pleotelson and uropod robust setal counts from margins (N = 20, subsample of 10 males and 10 females from AM P59352): Pleotelson: 1:1 (30%), 2:1 (40%), 2:2 (25%), 3:3 (5%). Endopod: (medial) 5 (10%), 6 (70%), 7 (20%); (lateral) 3 (65%), 4 (35%). Exopod: (medial) 4 (75%), 5 (25%); (lateral) 5 (10%), 6 (40%), 7 (45%), 8 (5%). Subadult males (19 mm, AM P59352) have the vas deferens opening almost flush to the surface of the sternite and the appendix masculina inserted submedially.

Size range. Maneas approximately 7 mm, adults to approximately 25 mm.

Etymology. Australis, Latin, southern, referring to the position of the type locality.

Distribution. Eastern and southern Tasmania; 1000–1312 metres.

Remarks. Cirolana australis is most readily differentiated by the ornamentation of the somites, coupled with the sinuate lateral margins and truncate apex of the pleotelson, low numbér of robust setae on the pleotelson apex, straight lateral margins of the uropod rami, and continuous distribution of the robust and plumose setae along the uropod exopod lateral margin. Other species of *Cirolana* in which robust setae occur on the margins of the pleotelson usually have six or more, but four have also been recorded in *C. rugicauda* Heller, 1861. *Cirolana rugicauda* is distinguished from *C. australis* by (in *C. rugicauda*): the rounded apex of the frontal lamina; the projecting clypeus (a character which has been used to diagnose genera and groups of genera excluding *Cirolana*, e.g. Bruce (1986)); and pleonite 3 enclosing pleonite 4 (Vanhöffen, 1914; Barnard, 1940; Kensley, 1978). *Cirolana sulcata* Hansen, 1890 and *Cirolana transcostata* Barnard, 1959 may be difficult to distinguish from *C. australis* but have a frontal lamina with a rounded apex, and uropods with lateral margins that are more convex. *Cirolana tuberculata* (Richardson, 1910) is also similar but has more prominent tubercles on the pleotelson and uropods with convex lateral margins (Delaney, 1986).

Cirolana comata sp. nov.

Figures 4–6

Material examined. Holotype. Portlock Reef, Coral Sea, Queensland (9°42.10′S 144°50.17′E), baited trap, unknown substrate, 65 m, S. Keable, 28 Jan 1993 (stn QLD-775), AM P59355 (male, 13 mm).

Paratypes. All same data as holotype, AM P39356 (298 specimens); BMNH 2000.2410–2411 (male, female); NMV J47152 (male, female); USNM 296461 (male, female).

Additional material. Off Flynn Reef, Queensland (16°41.32′S 146°18.26′E), baited trap, unknown substrate, 100 m, J. Lowry, P. Freewater and W. Vader, 7 Jun 1993 (stn SEAS QLD-937), AM P47678 (10 specimens); E of Fitzroy Reef, Queensland (23°32.53′S 152°16.45′E), baited trap, unknown substrate, 105 m, J. Lowry, P. Freewater and R. Springthorpe, 16 Jun 1993 (stn SEAS QLD-956), AM P47675 (13 specimens).

Diagnosis. Cephalon: rostrum not extending to frontal lamina, not dividing antennules; anterior margin not overriding antennules. Eyes: well developed, round with upper margin flat. Frontal lamina: anterior margin angled. Pereonites: without transverse carina; tubercles absent (except for 6 indistinct tubercles on submarginal anterior ridge of pereonite 1 in mature males). Pleonites: 3–5 with tubercles. Pleonite 4: ventral margin free of pleonite 3; posterodorsal margin apex broadly rounded dorsally but meeting convex ventral margin at a point. Pleotelson: dorsal surface with 2 paired tubercles, conspicuous fine setae forming dense patch in males; anterolateral margins almost straight and angling posteriorly toward midline; posterolateral margins straight, contiguous with anterolateral margins; apex rounded; 8–11 (usually 10) robust setae on margins. Penes: present. Pereopod 1: propodus without plumose

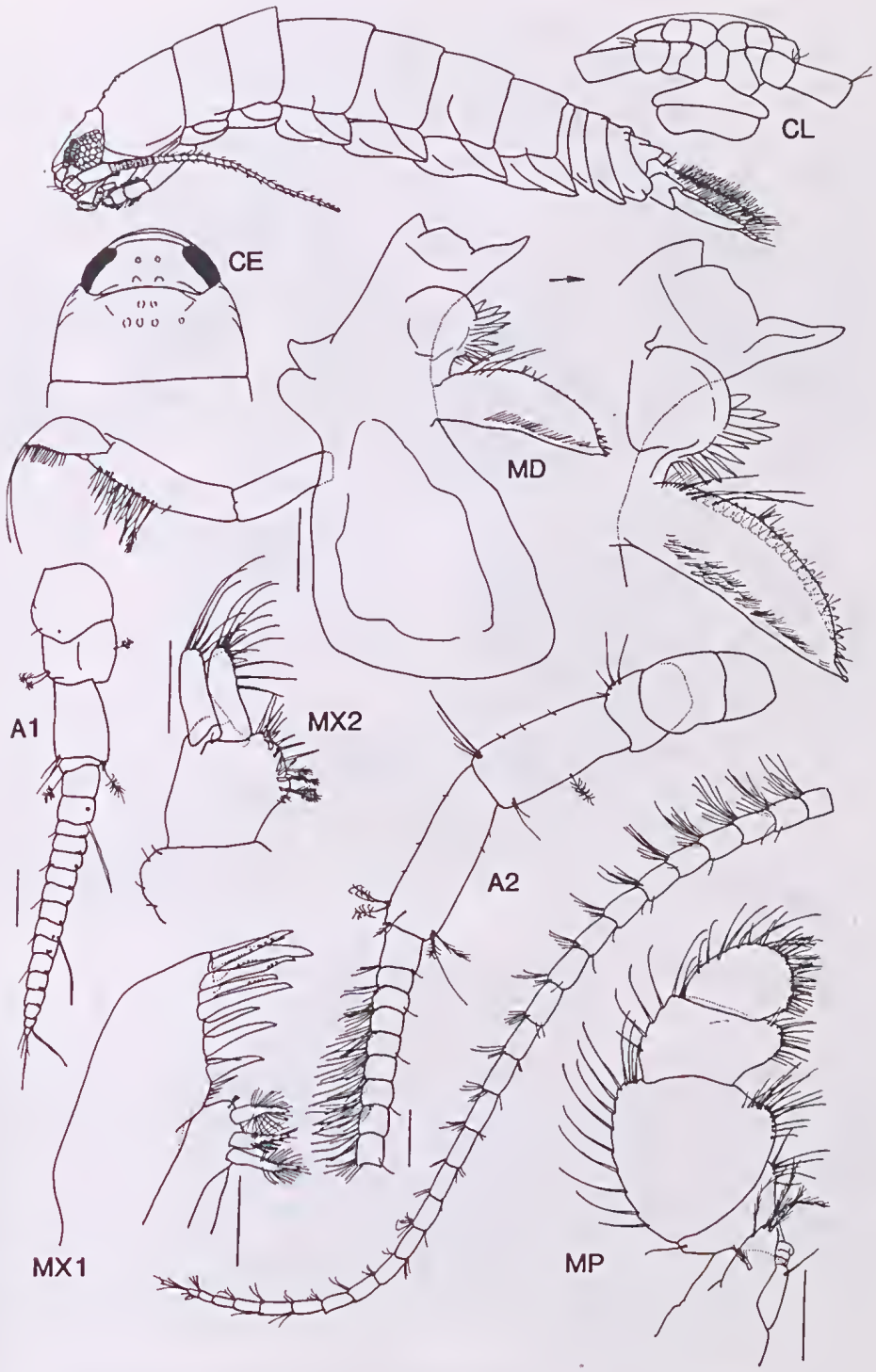

Figure 4. *Cirolana comata* sp. nov., holotype. Scales = 0.2 mm.

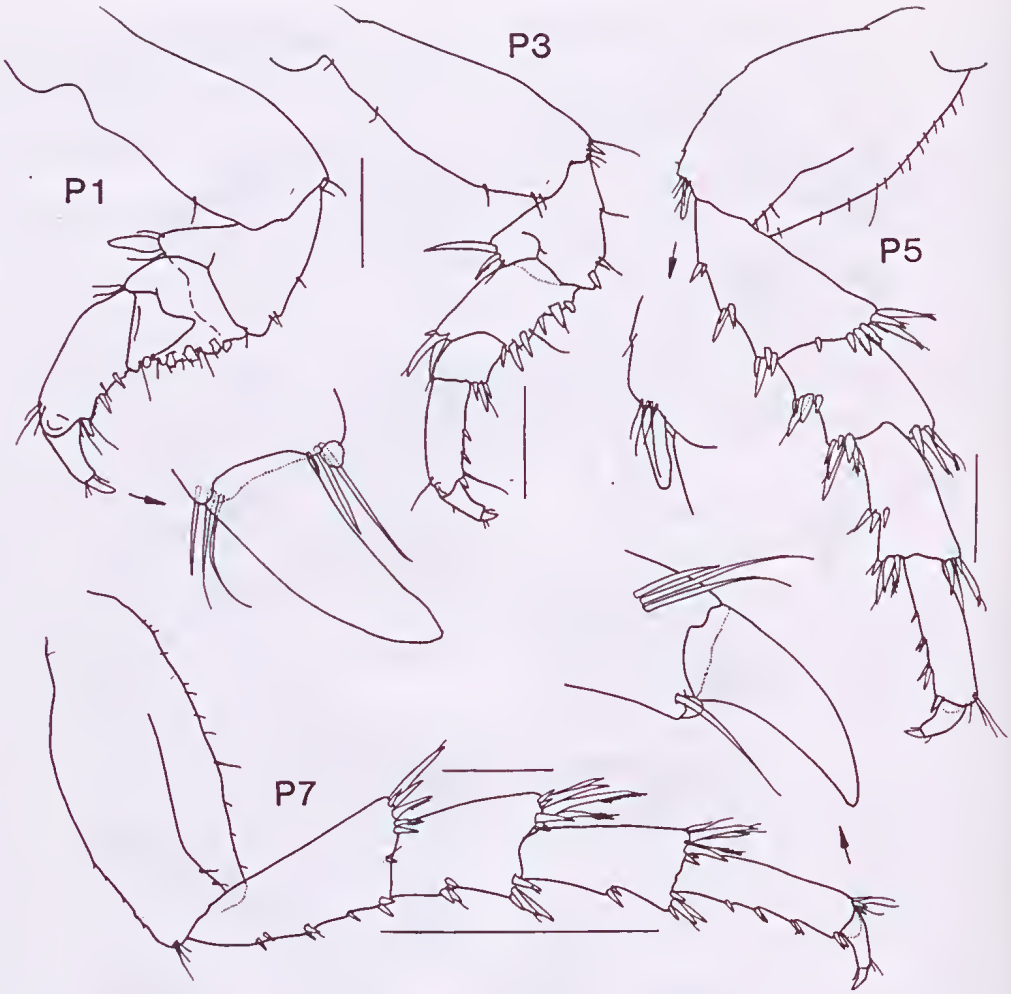

Figure 5. *Cirolana comata* sp. nov., holotype. Scales = 0.5 mm.

setae. Pereopods 4–6: basis posterodistal angle with 1 strongly sclerotized robust seta. Pleopod 2 appendix masculina: arising subbasally; extending beyond tip of endopod, 1.22 length of endopod from insertion point; margins straight, parallel along most of length, but tapering toward apex; slender; apex not at angle to margins, tapered to finely acute point. Uropods: endopod dimorphic, males with dorsal setae; lateral margin slightly convex. Exopod dimorphic, males with dorsal setae; lateral margin convex, robust and plumose setae continuous along margin.

Additional descriptive characters based on holotype. Body: length approximately 3.35 greatest width; cream in alcohol; chromatophores, small, brown in alcohol, scattered over body; Cuticular surfaces scale-like.

Cephalon: with 4 indistinct tubercles, 2 medially and 2 along posterior margin. Eyes: visible in ventral view; orange-tan in alcohol; partially overlapped by pereonite 1; ommatidia in rows, 10 ommatidia in horizontal diameter, 9 ommatidia in vertical diameter. Interocular furrow: distinct, extending across cephalon, smoothly convex. Frontal lamina: length approximately 2 basal width; pentagonal; lateral margins parallel; apex not projecting, not visible in dorsal view, not expanded, in 1 plane (not stepped). Clypeus: triangular, not produced.

Pereonites: 1 longest, 4–6 length subequal and longer than 2–3 and 7 which are subequal.

Pleonites: 1–5 visible but 1 almost completely

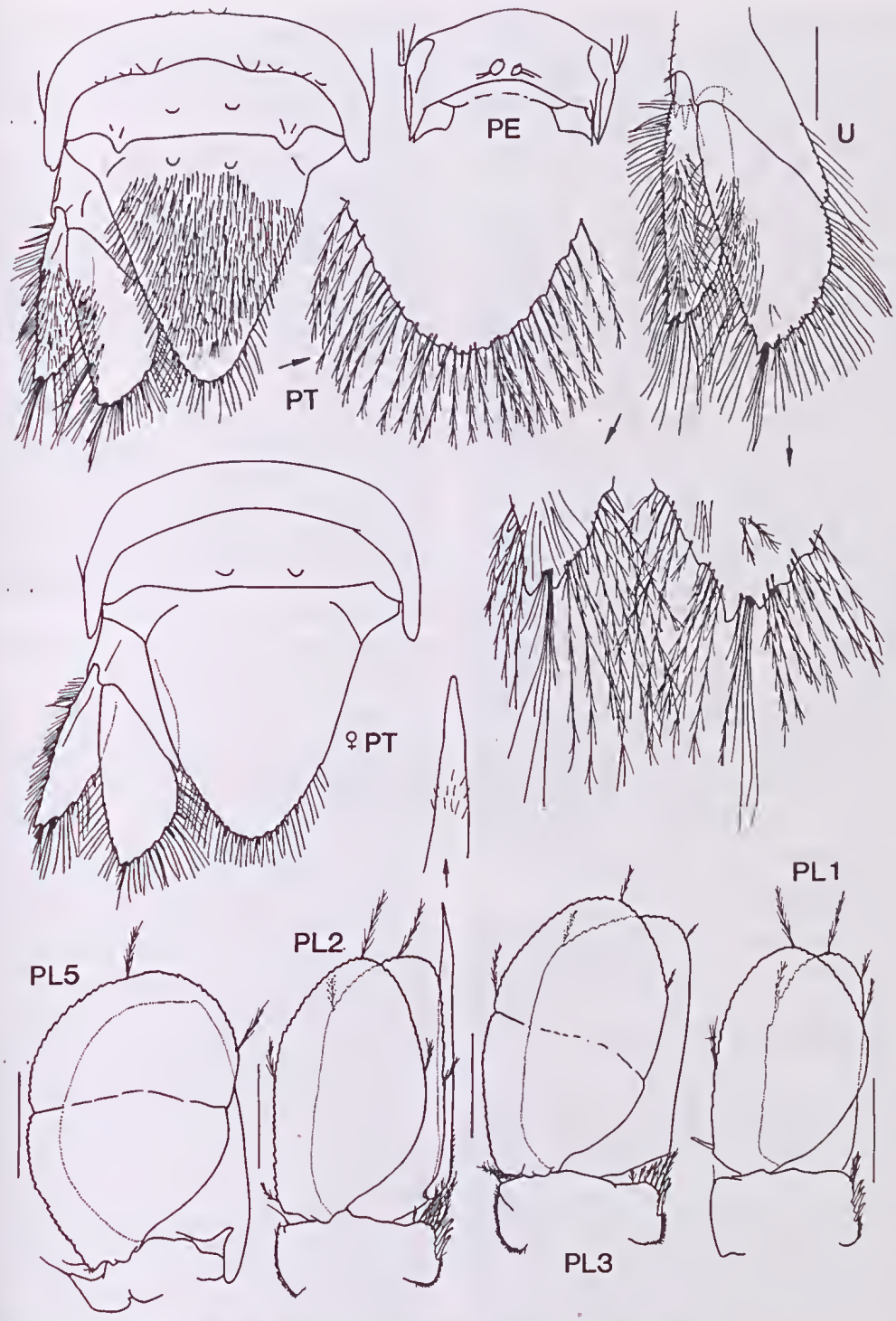

Figure 6. *Cirolana comata* sp. nov., holotype, except female = paratype, 17.5 mm, AM P59356. Scales = 0.5 mm.

concealed along dorsal margin by pereonite 7; tubercles not continuous across entire posterior margin, pleonite 3 tubercles small, subequal, pleonite 4 median tubercles prominent, pleonite 5 lateral tubercles prominent.

Pleotelson: length 0.88 basal width; anterodorsal uropodal sutures present; 5 robust setae on each posterolateral margin; plumose setae restricted to posterolateral margins, numerous proximal to robust setae.

Antennule: just reaching pereonite 1. Peduncular bases touching; articles 1–2 free; article 1 length subequal to width, greater than article 2; article 2 wider than long, anteromedial margin with 1 penicillate seta, posterodistal angle with 2 penicillate setae; article 3 shorter than combined lengths of articles 1–2, longer than article 1, length greater than width. Flagellum longer than peduncle; articles not compressed (lengths of most greater than half width); 16-articulate; aesthetases iridescent. Antenna: 0.41 length of body, when extended against body reaching to posterior of pereonite 4. Peduncular article 2 and article 3 subequal in length; article 4 much longer than article 3, with 4 slender setae at anterodistal angle, 1 penicillate seta on posteromedial margin, 2 slender setae at posterodistal angle; article 5 longer than article 4 and all other articles, with 1 slender and 2 penicillate setae at anterodistal angle, 2 penicillate and 1 slender setae at posterodistal angle. Flagellum 35-articulate; setal brush present.

Mandible: molar medial surface covered with short fine slender setae, cluster of long slender setae proximally present, long slender setae submarginal to anterior margin absent; marginal robust setae close set. Setal row with 11 robust setae; medial surface without setae. Maxillule: medial lobe lateral margin protuberance well developed; lateral lobe with 11 robust setae on distal surface. Maxilla: lateral lobe with 6 slender setae; medial lobe with 12 slender and 7 plumose setae, with 2 medial plumose setae longest and bent; middle lobe with 13 slender setae. Maxilliped: right and left endite with 2 coupling hooks.

Pereopods: 1–3 merus posterior margin robust setae strongly molariform on 1 only; 2–7 coxal furrows complete. Pereopod 1: posterior margin setose fringe absent; propodus robust; dactylus long, 0.5–1 propodus length.

Penes: separated by more than width of both penes; forming flattened lobes; length approximately 1.5 basal width.

Pleopods: exopod suture complete on 3–5 (but indistinct). Pleopod 1: exopod medial margin tapering evenly, proximolateral robust seta present; endopod length subequal to exopod, lateral margin slightly concave.

Uropods: extending beyond pleotelson. Peduncle ventrolateral angle with 2 robust setae and 1 plumose seta; lateral margin robust seta present; distolateral angle rounded. Endopod medial margin convex, with 6 robust setae, plumose setae along entire length; apex subbifid with lateral spine largest, without robust setae, setal cluster formed by plumose and slender setae; lateral margin with 2 robust setae, plumose setae along entire length. Exopod 0.86 length of endopod; medial margin convex, with 3 robust setae, plumose setae on distal two-thirds; apex subbifid with lateral spine largest, without robust setae, setal cluster formed by slender setae; lateral margin with 6 large robust setae, plumose setae along entire length.

Sexual dimorphism. Females differ from males in the primary sexual characters and do not develop the dense patches of setae found on the dorsal surface of the pleotelson, uropod endopod and uropod exopod, or the prominent lateral tubercles on pleonite 5 and dense brush of setae formed on the proximal articles of the antennal flagellum. The tubercles on the cephalon, pereonite 1, pleonites 3–4 and on the pleotelson are also absent in females.

Variation. Pleotelson and uropod robust setal counts from margins (N = 20, subsample of 10 males and 10 females from AM P39356): Pleotelson: 4:4 (5%), 4:5 (5%), 5:5 (85%) , 5:6 (5%). Endopod: (medial) 5 (70%), 6 (30%); (lateral) 1 (5%), 2 (95%). Exopod: (medial) 2 (5%), 3 (95%); (lateral): 5 (65%), 6 (35%). Males approximately 6 mm long lack tubercles, and the dorsal setae on the pleotelson and uropods.

Size range. Manceas approximately 3 mm, adults approximately 5–17.5 mm.

Etymology. Comata, Latin, hairy, referring to the dense setae found on the dorsal surfaces of the pleotelson and uropod rami in mature males.

Distribution. Off north-east Queensland; 65–105 metres.

Remarks. The prominent lateral tubercles on pleonite 5 and the dense patch of setae on the pleotelson distinguish mature males of *Cirolana comata* and *C. dissimilis* from those of other species in the genus. *Cirolana comata* differs from *C. dissimilis* in having a dense patch of setae on the dorsal surface of the uropod rami, a setal brush on the antenna in mature males and a strongly sclerotized robust seta at the posterodistal angle of the basis of pereopods 4–6 (4–5 in *C. dissimilis*). Females and immature males of *C. comata* and *C. dissimilis* are difficult to distinguish from other species but the lack of chromatophores, lack of strong tubercles or other sculpting on the somites, rostrum not extending to the frontal lamina, relatively high number of robust setae on the pleotelson, shape of the pleotelson, presence of a strongly sclerotized robust seta at the posterodistal angle of the basis of pereopods 4–5 (*C. dissimilis*), or 4–6 (*C. comata*), and the continuous distribution of the robust and

plumose setae along the uropod exopod lateral margin are diagnostic. *Cirolana indica* Nierstrasz, 1931, which is only known from a single female which lacks tubercles or ridges, may be similar to *C. comata* and *C. dissimilis*. However, *C. indica* is described as having a row of plumose setae along the posterodistal angle of the propodus of pereopod 1 which is lacking in these species. *Cirolana meinerti* Barnard, 1920 apparently has a patch of setae on the dorsal surface of the pleotelson and may also be similar to *C. comata* and *C. dissimilis* in other respects. However, *C. meinerti* is described as having medial tubercles on pleonite 5 which are more prominent than the lateral tubercles. This is not the case in *C. comata* or *C. dissimilis*. Mature males of *C. pleonastica* Stebbing, 1900 develop a dense patch of setae on the dorsal surface of the uropod exopod, as in *C. comata*. However, they do not develop a similar patch on the uropod endopod or the pleotelson (Bruce, 1995). *Cirolana comata* and *C. pleonastica* are also distinct in many other features including the sculpting of the somites, and the shape and setation of the pleotelson.

Cirolana dissimilis sp. nov.

Figures 7–9

Cirolana sp. 1.—Keable, 1997: 251.

Material examined. Holotype. Just off West Point, Darwin Harbour, Northern Territory (12°26.3′S 129°46.3′E), baited trap, unknown substrate but probably rock reef, 8 m, S. Keable, 8–9 Jul 1993 (stn NT-123), NTM Cr012796 (male, 18 mm).

Paratypes. All same data as holotype, AM P44797 (40 males, 40 females); BMNH 2000.2412–2413 (male, female); NMV J47151 (male, female); NTM Cr012797 (female); USNM 296462 (male, female).

Additional material. Bet Reef, Torres Strait, Queensland (10°10.54′S 142°56.01′E), baited trap, grey clay mud with shell grit, 20 m, S. Keable, 30–31 Jan 1993, AM P44799 (many specimens). Ngalaguru (High Cliffy) 1., Western Australia (15°54.77′S 124°20.68′E), baited trap, unknown substrate, unknown depth, F. Wells, 22–23 Nov 1994, AM P59357 (19 specimens).

Diagnosis. Cephalon: rostrum not extending to frontal lamina, not dividing antennules; anterior margin not overriding antennules. Eyes: well developed, round with upper margin flat. Frontal lamina: anterior margin angled. Pereonites: without transverse carina; tubercles absent (except for 4 indistinct tubercles on submarginal anterior ridge of pereonite 1 in mature males). Pleonites: 3–5 with tubercles. Pleonite 4: ventral margin free of pleonite 3; posterodorsal margin apex broadly rounded dorsally but meeting convex ventral margin at a point. Pleotelson: dorsal surface with 2 paired tubercles, conspicuous fine setae forming dense patch in males; anterolateral margins convex; posterolateral margins convex; apex rounded; 8–11 (usually 10) robust setae on margins. Pereopod 1: propodus without plumose setae. Pereopods 4–6: basis posterodistal angle with 1 strongly sclerotized robust seta on pereopods 4–5 only. Penes: present. Pleopod 2 appendix masculina: arising basally; extending beyond tip of endopod, 1.21 length of endopod from insertion point; margins straight, parallel along most of length, but tapering toward apex; slender; apex not at angle to margins, tapered to finely acute point. Uropods: endopod not dimorphic; lateral margin slightly convex; exopod not dimorphic; lateral margin straight, robust and plumose setae continuous along margin.

Additional descriptive characters based on holotype. Body: length approximately 3.6 greatest width; cream in alcohol; chromatophores absent; cuticular surfaces scale-like.

Cephalon: with tubercles, 4 indistinct along posterior margin. Eyes: visible in ventral view; black in alcohol; partially overlapped by pereonite 1; ommatidia in rows, 9 ommatidia in horizontal diameter, 8 ommatidia in vertical diameter. Interocular furrow: distinct, extending across cephalon, smoothly convex. Frontal lamina: length approximately 2 basal width; pentagonal; lateral margins concave; apex not projecting, not visible in dorsal view, not expanded, in 1 plane (not stepped). Clypeus: triangular, not produced.

Pereonites: 1, 4–6 length subequal and longest, 2–3 and 7 subequal.

Pleonites: 1–5 visible but 1 almost completely concealed along dorsal margin by pereonite 7; tubercles not continuous across entire posterior margin, pleonites 3–4 tubercles small and subequal, pleonite 5 lateral tubercles prominent.

Pleotelson: length 0.79 basal width; anterodorsal uropodal sutures present; 5 robust setae on each posterolateral margin; plumose setae restricted to posterolateral margins, numerous proximal to robust setae.

Antennule: just reaching pereonite 1. Peduncular bases touching; articles 1–2 free; article 1 length subequal to width, subequal to article 2; article 2 longer than wide, with 1 penicillate seta at posterodistal angle and on anterolateral margin; article 3 shorter than combined lengths of articles 1–2, longer than article 1, length greater than width. Flagellum longer than peduncle; articles not compressed (lengths of most greater than half width); 19-articulate; aesthetases iridescent. Antenna: 0.38 length of body, when extended against body reaching to posterior of pereonite 4. Peduncular article 2 shorter than article 3; article 4 much longer than article 3, with 1 penicillate seta on posterolateral margin, 3 slender setae at posterodistal angle; article 5

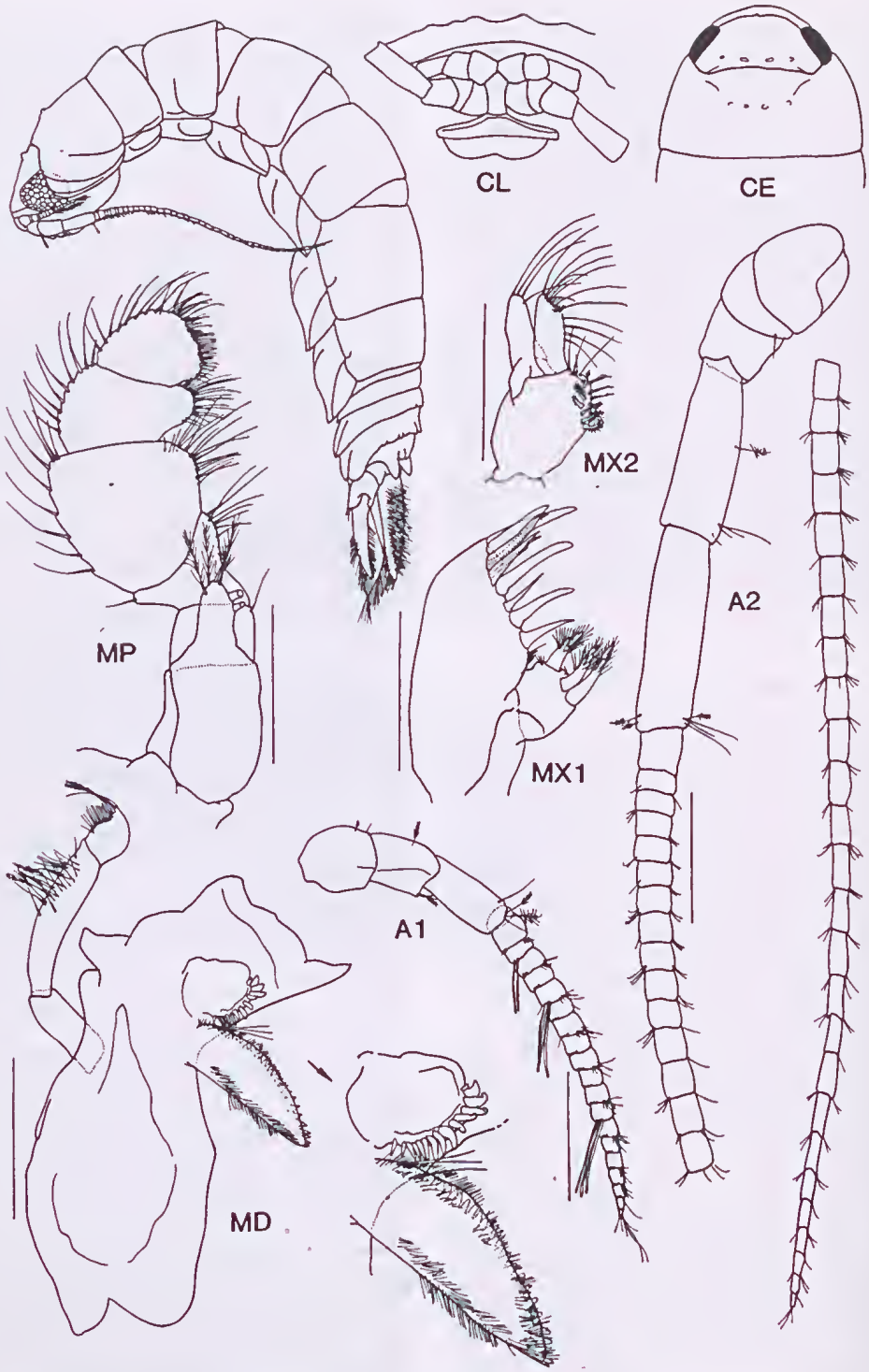

Figure 7. *Cirolana dissimilis* sp. nov., holotype. Scales = 0.5 mm.

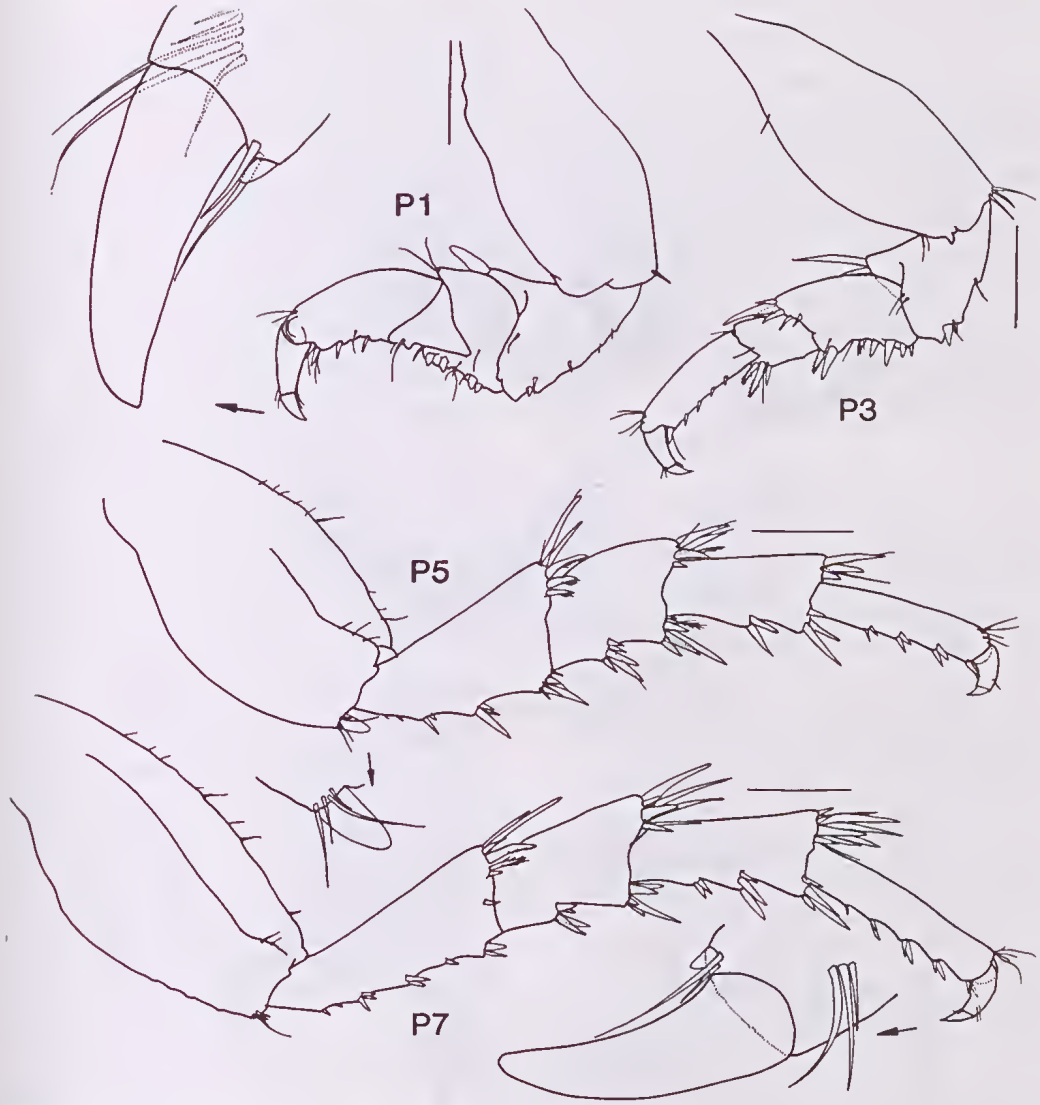

Figure 8. *Cirolana dissimilis* sp. nov., holotype. Scales = 0.5 mm.

longer than article 4 and all other articles, with 2 penicillate setae at anterodistal angle, 4 slender and 1 penicillate setae at posterodistal angle. Flagellum 41-articulate; setal brush absent.

Mandible: molar medial surface covered with short fine slender setae, cluster of long slender setae proximally present, long slender setae submarginal to anterior margin absent; marginal robust setae close set. Setal row with 15 robust setae; medial surface without setae. Maxillule: medial lobe lateral margin protuberance well developed; lateral lobe with 10 robust setae on distal surface. Maxilla: lateral lobe with 4 slender setae; medial lobe with 4 slender and 14 plumose setae, with medial plumose seta longest and bent; middle lobe with lateral row of 10 long slender setae and medial row of 10 short slender setae. Maxilliped: right and left endite with 2 coupling hooks.

Pereopods: 1–3 merus posterior margin robust setae strongly molariform on 1 only; 2–7 coxal furrows complete. Pereopod 1: posterior margin setose fringe absent; propodus robust; dactylus long, 0.5–1 propodus length.

Penes: separated by more than width of both penes; forming flattened lobes; length approximately 1.5 basal width.

Pleopods: exopod suture complete on 3–5 (but

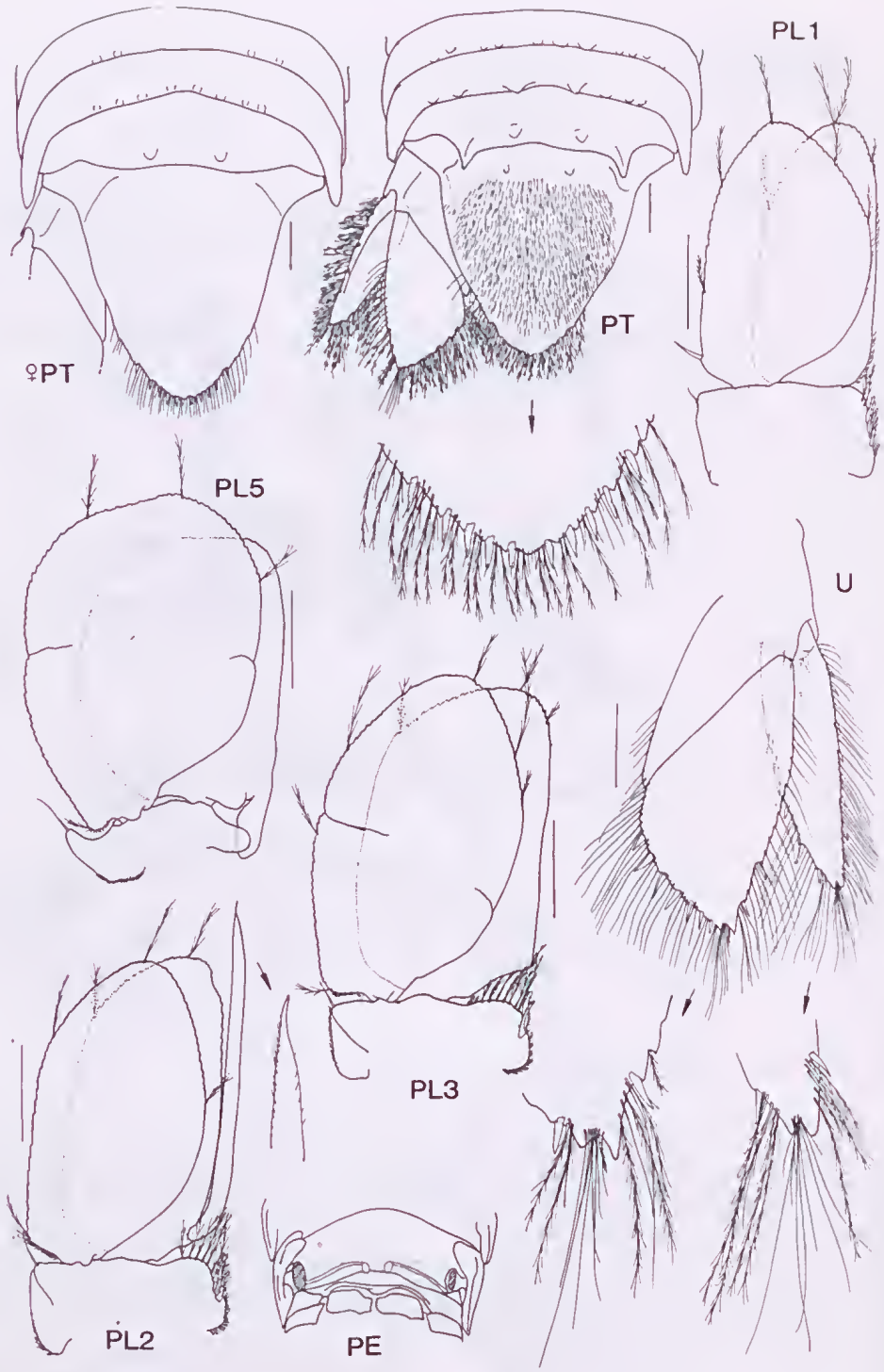

Figure 9. *Cirolana dissimilis* sp. nov., holotype, except female = paratype, 21 mm, AM P44797. Scales = 0.5 mm.

indistinct). Pleopod 1: exopod medial margin tapering evenly, proximolateral robust seta present; endopod length subequal to exopod, lateral margin straight.

Uropods: extending beyond pleotelson. Peduncle ventrolateral angle with 2 robust setae and 2 plumose setae; lateral margin robust seta absent; distolateral angle rounded. Endopod medial margin convex, with 7 robust setae, plumose setae along entire length; apex subbifid with lateral spine largest, without robust setae, setal cluster formed by slender setae; lateral margin with 2 robust setae, plumose setae along entire length. Exopod 0.83 length of endopod; medial margin convex, with 3 robust setae, plumose setae on distal two-thirds; apex subequally bifid, without robust setae, setal cluster formed by slender setae; lateral margin with 7 large robust setae, plumose setae along entire length.

Sexual dimorphism. Females differ from males in the primary sexual characters and do not develop the dense patch of setae found on the dorsal surface of the pleotelson or the prominent lateral tubercles found on pleonite 5. The tubercles on pleonites 3–4 and on the pleotelson are also less conspicuous in females and are absent in specimens smaller than approximately 20 mm. The indistinct tubercles on the cephalon and pereonite 1 are also absent in females.

Variation. Pleotelson and uropod robust setal counts from margins (N = 20, subsample of 10 males and 10 females from AM P44797): Pleotelson: 4:4 (15%), 4:5 (25%), 5:5 (55%), 5:6 (5%). Endopod: (medial) 5 (20%), 6 (55%), 7 (25%); (lateral) 2 (100%). Exopod: (medial) 3 (95%), 4 (5%); (lateral) 5 (15%), 6 (45%), 7 (40%). In males, development of tubercles on the somites and the patch of setae on the pleotelson appear to be associated with maturity. Males approximately 9 mm long lack tubercles, while males approximately 12 mm long have tubercles on the cephalon and pereonite 1, and weakly developed on the pleonites. Males of 12 mm in length, and shorter, lack the patch of setae on the pleotelson.

Size range. Adults 7.5–21 mm.

Etymology. Dissimilis, Latin, dissimilar, referring to the sexually dimorphic pleotelson and pleon.

Distribution. Off Kimberley region, Western Australia; Darwin Harbour, Northern Territory; Torres Strait, Queensland; 8–20 m.

Remarks. See *Cirolana comata.* Keable (1997) recorded that in Darwin Harbour *Cirolana dissimilis* (as *C.* sp. 1) was one of the numerically dominant scavengers collected among subtidal rock and coral reef habitats, and was also collected in lower numbers from the scour zone of the main channels where gravel sediments predominate.

Acknowledgements

I thank Drs J. Lowry and P. Berents for making the material available for study, and Dr F. Wells for collecting and donating the specimens from Western Australia. Drs N. Bruce and R. Brusca kindly provided unpublished character lists for cirolanid isopods which were useful in writing the species descriptions. I am also grateful to Dr P. Berents, Dr G. Poore and an anonymous reviewer for comments on drafts of the manuscript, and to Mr R. Springthorpe who composed and inked my illustrations. This study was undertaken while in receipt of an Australian Museum Collection Visiting Fellowship.

References

Barnard, K.H., 1920. Contributions to the crustacean fauna of south Africa. 6. Further additions to the list of marine Isopoda. *Annals of the South African Museum* 17: 319–348.

Barnard, K.H., 1936. Isopods collected by the R.I.M.S. "Investigator". *Records of the Indian Museum* 38: 147–191.

Barnard, K.H., 1940. Contributions to the Crustacean Fauna of South Africa. XII. Further additions to the Tanaidacea, Isopoda, and Amphipoda, together with keys for the identification of the hitherto recorded marine and fresh-water species. *Annals of the South African Museum* 32: 381–515.

Barnard, K.H., 1959. New and little-known South African marine isopods (Crustacea). *Annals and Magazine of Natural History* (13) 1: 715–720.

Berrow, S., 1994. Fish predation by the marine crustaceans *Orchomene nana and Natatolana borealis. Irish Naturalists' Journal* 24: 514.

Bird, P.M., 1981. The occurrence of *Cirolana borealis* (Isopoda) in the hearts of sharks from Atlantic coastal waters of Florida. *United States Fishery Bulletin* 79: 376–383.

Botosaneanu, L. and Iliffe, T.M., 1997. Four new stygobitic cirolanids (Crustacea: Isopoda) from the Caribbean — with remarks on intergeneric limits in some cirolanids. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie* 67: 77–94.

Bruce, N.L., 1981a. Cirolanidae (Crustacea: Isopoda) of Australia: diagnoses of *Cirolana* Leach, *Metacirolana* Nierstrasz, *Neocirolana* Hale, *Anopsilana* Paulian and Deboutteville, and three new genera — *Natatolana, Politolana* and *Cartetolana. Australian Journal of Marine and Freshwater Research* 32: 945–966.

Bruce, N.L., 1981b. The Cirolanidae (Crustacea: Isopoda) of Australia: new species and a new genus from southeastern Australia. *Records of the Australian Museum* 33: 644–672.

Bruce, N.L., 1986. Cirolanidae (Crustacea: Isopoda) of Australia. *Records of the Australian Museum* 6 (suppl.): 1–239.

Bruce, N.L., 1991. New records of marine isopods crustaceans (Sphaeromatidae, Cirolanidae) from southeastern Australia. *Memoirs of the Museum of Victoria* 52: 263–275.

Bruce, N.L., 1993. Two new genera of marine isopod crustaceans (Cirolanidae) from Madang, Papua New Guinea. *Memoirs of the Queensland Museum* 33: 1–15.

Bruce, N.L., 1995. *Cirolana* and related marine isopod crustacean genera (family Cirolanidae) from the coral reefs of Madang, Papua New Guinea. *Cahiers de Biologie Marine* 35: 375–413.

Bruce, N.L., 1996. Crustacea Isopoda: Some Cirolanidae from the MUSORSTOM cruises off New Caledonia. In Crosnier, A. (ed.), *Résultats des Campagnes MUSORSTOM, Volume 15. Mémoires du Muséum national d'Histoire Naturelle* 168: 147–166.

Brusca, R.C., Wetzer, R. and France, S.C., 1995. Cirolanidae (Crustacea: Isopoda: Flabellifera) of the tropical eastern Pacific. *Proceedings of the San Diego Society of Natural History* 30: 1–96.

Delaney, P.M., 1986. The synonymy of *Cirolana tuberculata* (Richardson, 1910) (Isopoda: Flabellifera: Cirolanidae). *Proceedings of the Biological Society of Washington* 99: 731–734.

Hale, H.M., 1925. Review of Australian isopods of the cymothoid group. Part 1. *Transactions of the Royal Society of South Australia* 49: 128–185.

Hansen, H.J., 1890. Cirolanidae et familiae nonnullae propinquae Musaei Hauniensis. *Det Kongelige Danske Videnskabernes Selskabs Skrifter, Naturvidenskabelig og Mathematisk Afdeling* 6: 239–426.

Heller, C., 1861. Vorlaufiger bericht uber die warhend der weltumseglung der k.k. Fregatte *Novara* gesammelten crustaecen. *Verhandlungen der Zoologisch-botanischen Gesellschaft in Wien* 11: 495–498.

Hobbins, C.St C. and Jones, D.A., 1993. New species of deep sea isopods from the Red Sea and north western Indian Ocean: families Cirolanidae and Corallanidae. *Senckenbergiana Maritima* 23: 115–134.

Javed, W. and Yasmeen, R., 1990. A new species of cirolanid isopod of the genus *Neocirolana* from Pakistan with a review of the genus. *Crustaceana* 58: 67–73.

Javed, W. and Yasmeen, R., 1995. A new cirolanid isopod of the genus *Cirolana* from the Pakistan coast, northern Arabian Sea. Pp. 119–124 in Thompson, M.-F. and Tirmizi, N.S. (eds), *The Arabian Sea: Living Marine Resources and the Environment*. Vanguard Press: Lahore.

Keable, S.J., 1995. Structure of the marine invertebrate seavenging guild of a tropical reef ecosystem: field studies at Lizard Island, Queensland, Australia. *Journal of Natural History* 29: 27–45.

Keable, S.J., 1997. The Cirolanidae (Crustacea: Isopoda) of Darwin Harbour, Northern Territory, with additional records from northern Australia and Papua New Guinea. Pp 245–278 in Hanley, J.R., Caswell, G., Megirian, D. and Larson, H. K. (eds), *Proceedings of the Sixth International Marine Biological Workshop. The marine flora and fauna of Darwin Harbour, Northern Territory, Australia*. Museums and Art Galleries of the Northern Territory and the Australian Marine Sciences Association: Darwin.

Keable, S.J., 1998. A third species of *Aatolana* Bruce, 1993 (Crustacea: Isopoda: Cirolanidae). *Records of the Australian Museum* 50: 19–26.

Keable, S.J., 1999. Description of a new species of *Dolicholana* Bruce, 1986 (Crustacea: Isopoda: Cirolanidae) and a redescription of *Dolicholana porcellana* (Barnard, 1936) comb. nov. *Journal of Natural History* 33(3): 395–414.

Kensley, B., 1978. *Guide to the marine isopods of southern Africa*. Trustees of the South African Museum: Cape Town. 173 pp.

Kensley, B., 1984. The South African Museum's *Meiring Naude* cruises. Part 15. Marine Isopoda of the 1977, 1978, 1979 cruises. *Annals of the South African Museum* 93: 213–301.

Kensley, B. and Schotte, M. 1989. *Guide to the marine isopod crustaceans of the Caribbean*. Smithsonian Institution Press: Washington. 308 pp.

Koslow, J.A. and Gowlett-Holmes, K. 1998. *The seamount fauna off southern Tasmania: Benthic communities, their conservation and impacts of trawling. Final report to Environment Australia and The Fisheries Research Development Corporation*. FRDC Project 95/058. Environment Australia: Canberra. 104 pp.

Kussakin, O.G., 1979. Marine and brackish-water Crustacea (Isopoda) of cold and temperate waters of the Northern Hemisphere. Suborder Flabellifera. *Opredeliteli po Faune SSR, Akademiya Nauk, SSSR* 122: 1–472. In Russian.

Kwon, D.H., 1988. A systematic study on the Korean marine isopod crustaceans 1. Flabellifera Part 1. Family Cirolanidae. *Inje Journal* 4: 353–370.

Leach, W.E., 1818. Cymothoadées. In: F., Cuvier, *Dictionnaire des sciences naturelles* 12: 338–354. Leurault: Paris and Strasbourg.

Lowry, J.K., 1998. Scavenging crustaceans from CSIRO Seamount Cruise SS 01/97. Pp. 61–64 in Koslow, J.A. and Gowlett-Holmes, K., *The seamount fauna off southern Tasmania: Benthic communities, their conservation and impacts of trawling. Final report to Environment Australia and The Fisheries Research Development Corporation. FRDC Project 95/058*. Environment Australia: Canberra. 104 pp.

Mezhov, B.V., 1981. Isopoda. Pp. 62–82 in Shirshov, P.P. (ed.), *Benthos of the submarine mountains Marcus-Necker and adjacent Pacific regions*. Academy of Sciences of the U.S.S.R., Institute of Oceanology.

Miers, E.J., 1884. Crustacea. *Report of the Zoological Collections made in the Indo-Pacific Ocean during the voyage of HMS 'Alert', 1881–1882*: 178–331, 513–575, pls. 18–34, 46–52

Mizzan, L., 1995. *Cirolana* cfr. *neglecta* Hansen, 1890 (Crustacea, Isopoda, Cirolanidae) nelle coste del Veneziano: note su di un attacco ad una postazione di pesca. *Bolletino del Civico di Storia naturale, Venezia* 44: 145–151.

Nierstrasz, H.F., 1931. Die Isopoden der Siboga-Expedition. 3. Isopoda Genuina. 2. Flabellifera. *Siboga-Expeditie Monograph* 32c: 123–233.

Nunomura, N., 1985. *Cirolana albicauda*, a new cirolanid isopod from the Sea of Owase, Middle Japan. *Bulletin of the Toyama Science Museum* 7: 73–76.

Paulian, R. and Delmare Debouteville, C., 1956. Un cirolanide cavernicole à Madagascar (Isopode). *Mémoires de l'Institut Scientifique de Madagascar* (A)11: 85–88.

Richardson, H., 1901. Keys to the isopods of the Atlantic coast of North America, with descriptions of new and little-known species. *Proceedings of the United States National Museum* 23: 493–579.

Richardson, H., 1910. Marine isopods collected in the Philippines by U.S. Fisheries Steamer *Albatross* in 1907–1908. *Department of Commerce and Labor, Bureau of Fisheries Document* 736: 1–44.

Stebbing, T.R.R., 1900. On Crustacea brought by Dr. Willey from the South Seas. In: Willey, A. (ed.), *Zoological results based on material from New Britain, New Guinea, Loyalty Islands, and elsewhere, collected during the years of 1895, 1896 and 1897* 5(33): 605–690, pls 64–74. University Press: Cambridge.

Stepien, C.A.and Brusca, R.C., 1985. Nocturnal attacks on nearshore fishes in southern California by crustacean zooplankton. *Marine Ecology Progress* Series 25: 91–105.

Vanhöffen, E., 1914. Die Isopoden der Deutschen Südpolar-Expedition 1901–1903. *Deutsche Südpolar Expedition*, 1901–1903 15: 447–598.

Wieder, R.W. and Feldmann, R.M., 1992. Mesozoic and Cenozoic fossil isopods of North America. *Journal of Paleontology* 66: 958–972.